[0163] In yet a further test, flash intensity was evaluated. Differences in apparent flash brightness were observed between six separate devices **5**. A testing regime was set up to determine differences in flash intensity between a matrix of five flash units **30** and the six separate devices **5**. Differences were observed at first in total flash energy. After updating the flash control software, more tests were undertaken. Those results are presented in **FIG. 34**.

[0164] **FIG. 34** shows that the range of variability between individual flash units **30** in a single device **5** can be significant. Among other things, this variability is a result of the differences inherent in the flash tubes. **FIG. 34** also shows that variation in flash performance can be attributed to the device **5**. However, it is considered that variability, such as demonstrated in regard to flash performance, can be easily accounted for through various calibration techniques.

[0165] While described in the context of the hand-held, portable color measurement device **5**, it should be appreciated that certain aspects of these teachings may be practiced with systems that are not portable or hand-held, or that are intended to be operated in a fixed location, or that are integrated into larger systems, such as spectrophotometers. In some applications, the device **5** could be installed within or with another type of hand-held device, such as a portable data terminal or a voice communication device.

[0166] In some embodiments, appropriate hardware and/or software are combined with various commercially available products, such as a palm-top device equipped with an imaging system to provide for a device **5** as disclosed herein.

[0167] Further, by example, the device **5** could be combined with a laptop computer, wherein the laptop computer assembles data in a database as a result of measurements. This embodiment may be helpful in the situation where law enforcement officials need to collect forensic information indicating an origin of counterfeit documents.

[0168] Note as well that the transmitted data derived from color measurement may be combined with other data that is automatically generated or that is manually entered into the device **5** using the keyboard **50**.

[0169] Note as well that the device **5** can operate in conjunction with other devices which may be connected in a network. For example, the device **5** could be used with another device **5**, both of which are connected to a laptop computer. In this configuration, the user could simultaneously produce color coordinates for a color target **200**, using multiple color classification algorithms **18**A. In another embodiment, the use of a microphone **25** could facilitate note taking in field environments.

[0170] A result is that rapid evaluations of security features, such as particles **1150**, as disclosed herein are made possible, with the hand held device **5** that produces digital color data. This device **5** is capable of supporting a variety of information and communication protocols, which lend versatility to the device **5** and the applications for which it may be used. The device **5** may operate as an integrated and stand alone unit, or as a part of a system and therefore provide data to a remote user.

[0171] Thus, it should be appreciated that while these teachings have been particularly shown and described with respect to preferred embodiments thereof, it will be understood by those skilled in the art that changes in form and details may be made therein without departing from the scope and spirit of the invention.

1. A method for authentication of a substrate, the method comprising:

generating a color image of the substrate, the color image comprising pixels;

identifying at least one region of authentically colored pixels by comparing the color of at least a portion of the pixels to at least one predetermined color in a first comparison test;

determining at least one morphological aspect for the identified at least one region by operation of a morphological determination algorithm;

comparing the at least one morphological aspect of the identified at least one region to at least one predetermined morphological value in a second comparison test; and,

authenticating the substrate if the first comparison test and the second comparison test are successful.

2. The method as in claim 1, wherein the morphological determining algorithm comprises counting pixels along a perimeter of the at least one region.

3. The method as in claim 2, wherein counting pixels comprises counting contiguous pixels where an outer edge of the region of authentically colored pixels appears.

4. The method as in claim 2, wherein counting pixels along the perimeter further comprises accounting for edge effects along the perimeter.

5. The method as in claim 1, wherein the at least one morphological aspect comprises at least one of a shape, a size, a thickening, a direction, and a thinning of the at least one region.

6. The method as in claim 1, wherein the morphological determination algorithm comprises an algorithm for performing one of a connected components analysis, a thickening analysis, a directional analysis and a hit-or-miss transform analysis.

7. The method as in claim 1, further comprising:

counting a number of occurrences of acceptable results and unacceptable results for the first comparison test and the second comparison test; and

comparing the number of these occurrences to a predetermined value for success to determine success.

8. The method as in claim 7, wherein the predetermined value for success comprises: a threshold against false positive detection.

9. The method as in claim 1, further comprising:

tracking a number of unacceptable results for at least one of the first comparison test and the second comparison test and decertifying at least one of the predetermined color and the morphological aspect where the number of unacceptable results is above a predetermined threshold.

10. The method as in claim 1, wherein the identifying at least one region further comprises:

identifying pixels in the at least a portion of the pixels that comprise a gray level that exceeds a predetermined value.